# APPENDIX M

# SUMMER 2009 OFFSHORE ENVIRONMENTAL SAMPLING REPORT FOR THE ROCKAWAY DELIVERY LATERAL PROJECT

# Summer 2009
# Offshore
# Environmental Sampling Report
# for the Rockaway Delivery Lateral Project
# Queens, New York

**September 2009**

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# List of Abbreviations and Acronyms

| | |
|---|---|
| BOD | biological oxygen demand |
| BTX | Benzene, Toluene, Xylene |
| DDD | dichlorodiphenyldichloroethane |
| DDE | dichlorodiphenyldichloroethylene |
| DDT | dichlorodiphenyltrichloroethane |
| DO | dissolved oxygen |
| °C | degrees Celsius |
| °F | degrees Fahrenheit |
| E & E | Ecology and Environment, Inc. |
| FERC | Federal Energy Regulatory Commission |
| H | Shannon's Diversity Index |
| HDD | horizontal directional drill |
| m | meter |
| MDQ | Minimum Detectable Quantity |
| mg/L | milligrams per liter |
| MMcfd | million cubic feet per day |
| NYSDEC | New York State Department of Environmental Conservation |
| NTU | Nephelometric Turbidity Units |
| PAHs | polycyclic aromatic hydrocarbons |
| PCBs | polychlorinated biphenyls |
| ppt | parts per thousand |

## List of Abbreviations and Acronyms (cont.)

| | |
|---|---|
| ROV | remotely operated vehicle |
| SVOC | semi-volatile organic compound |
| TAL | Target Analyte List |
| TBTA | Tri-borough Bridge and Tunnel Authority |
| TOC | total organic carbon |
| TOGS | Technical and Operational Guidance Series |
| Transco | Transcontinental Gas Pipe Line Company, LLC |
| TSS | total suspended solids |
| VOC | volatile organic compound |

# 1 Introduction

Transcontinental Gas Pipe Line Company, LLC (Transco), is filing an application with the Federal Energy Regulatory Commission (FERC) seeking all of the necessary authorizations pursuant to the Natural Gas Act to create a new lateral on its existing system to provide an additional service point to National Grid US's local distribution companies of Brooklyn Union Gas Company, D/B/A National Grid NY and KeySpan Gas East Corporation in the New York City market area (National Grid). The Rockaway Delivery Lateral Project (the Project) will enhance reliability and position National Grid to serve growth by providing an additional delivery point into their system. The FERC application for the Project requires the submittal of 12 Resource Reports, with each report evaluating Project effects on a particular aspect of the environment.

The proposed pipeline would consist of approximately 3.22 miles of 26-inch diameter pipeline from a proposed offshore interconnect with Transco's existing Lower New York Bay Extension, in the Atlantic Ocean near Lower New York Bay, to a delivery point onshore into the National Grid pipeline system on the Rockaway Peninsula in Queens County, New York, as shown on Figure 1-1. Construction of the pipeline would allow the movement of up to 557 MMcfd to National Grid's regional distribution system and would support the City of New York's clean air initiatives, which will limit the use of high sulfur oils.

Transco proposes to cross the beach and the nearshore portion of the pipeline using Horizontal Directional Drill (HDD) techniques. The proposed HDD would be 0.60 miles long, while the remaining 2.62 miles of the offshore segment would be installed using conventional marine lay and trenching methods. The 0.35-mile onshore segment of the pipeline primarily extends beneath a pitch-and-putt golf course located within the Jacob Riis Park to a proposed tie-in point with National Grid to be located within the Tri-borough Bridge and Tunnel Authority (TBTA) right-of-way. Beach 169th Street and Fort Tilden are located to the west of the proposed pipeline. A parking lot and additional land within Jacob Riis Park are located to the east. Jacob Riis Park and Fort Tilden are part of Gateway National Recreation Area, which is managed by the National Park Service. Transco is also proposing to construct a meter and regulating station northwest of Floyd Bennett Field along Flatbush Avenue. Floyd Bennett Field is also part of Gateway National Recreation Area.

Ecology and Environment, Inc. (E & E) was contracted by Transco to support the environmental compliance/permitting requirements for the Project. In order for the FERC application, permits, and, ultimately, the installation processes to move forward, it was necessary to evaluate the physical, chemical, and biological characteristics along the proposed pipeline route. Prior to undertaking the field activities, a sampling and analysis plan was prepared and submitted to regulatory agencies to provide them with the opportunity to comment on and, if necessary, request modifications to ensure adequacy of data for the agency review. The Sampling and Analysis Plan prepared for the Project is provided in Appendix A. The field sampling effort took place from June 23 through July 13, 2009. A summary of the field data collected as part of the sampling effort in the Atlantic Ocean is provided below. Although geotechnical, archaeological, and deep sediment core data were collected and analyzed as part of this field effort, this report presents only the results supporting the biological and water quality evaluations for the Project. Geotechnical boring logs will be provided as appendices to Resource Report 7, Soils, of the FERC Environmental Report, and the results of archaeological investigations will be presented in Resource Report 4, Cultural Resources.

This report discusses all environmental field parameters collected, including:

- Sediment chemical contamination;
- Physical and chemical water quality parameters;
- Benthic community analysis; and
- Drop camera video of the proposed pipeline route.

The appendices at the end of this report provide all field data collected as part of the sampling effort. Appendix A presents the Sampling and Analysis Plan developed for the data collection effort; Appendix B presents the laboratory results for all chemical parameters analyzed; Appendix C presents the Marine Biology Report that discusses the results of the benthic sampling and subsurface video performed at each sample location; Appendix D contains CD including the raw video collected with the drop camera and ROV camera.

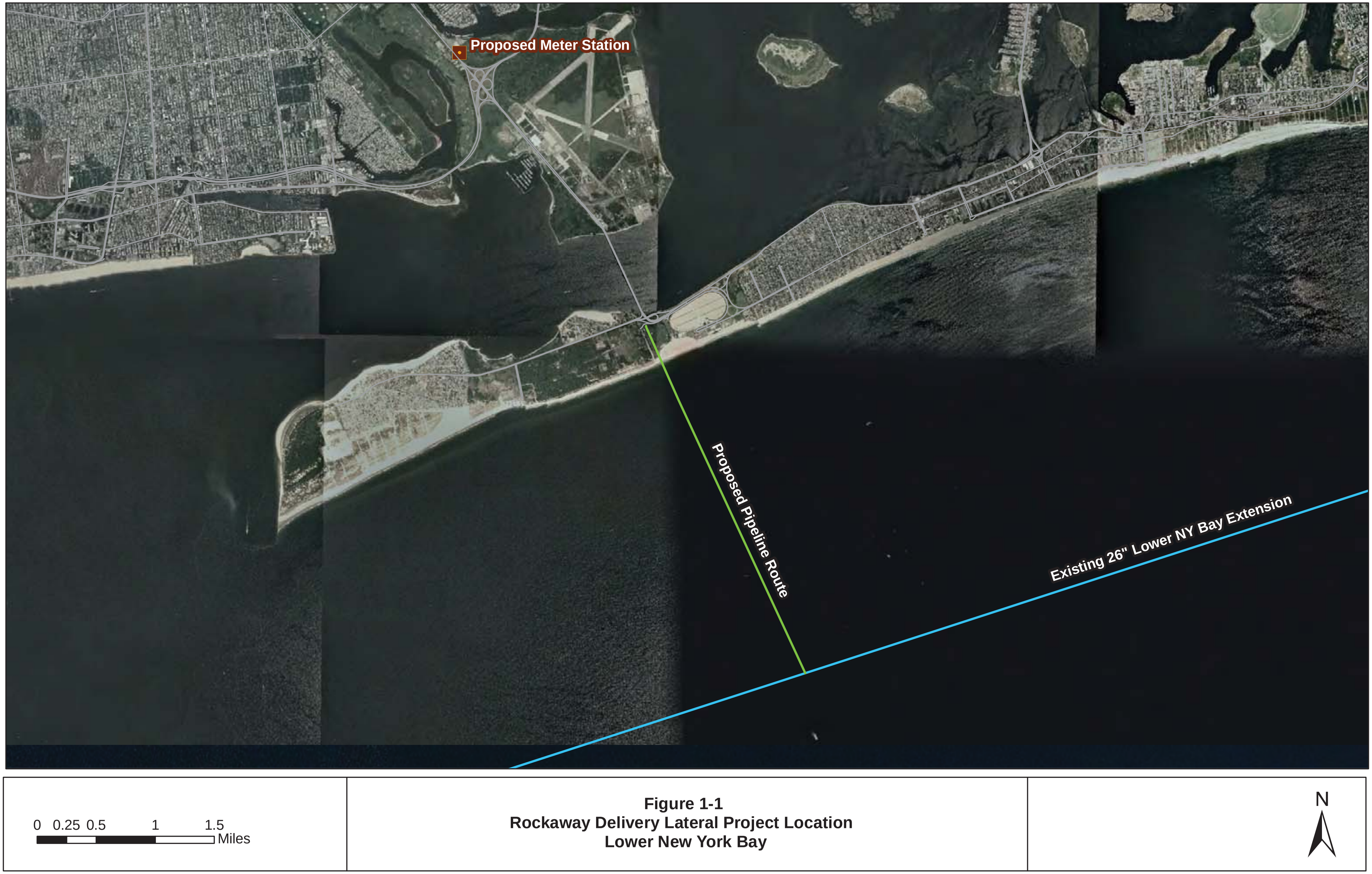
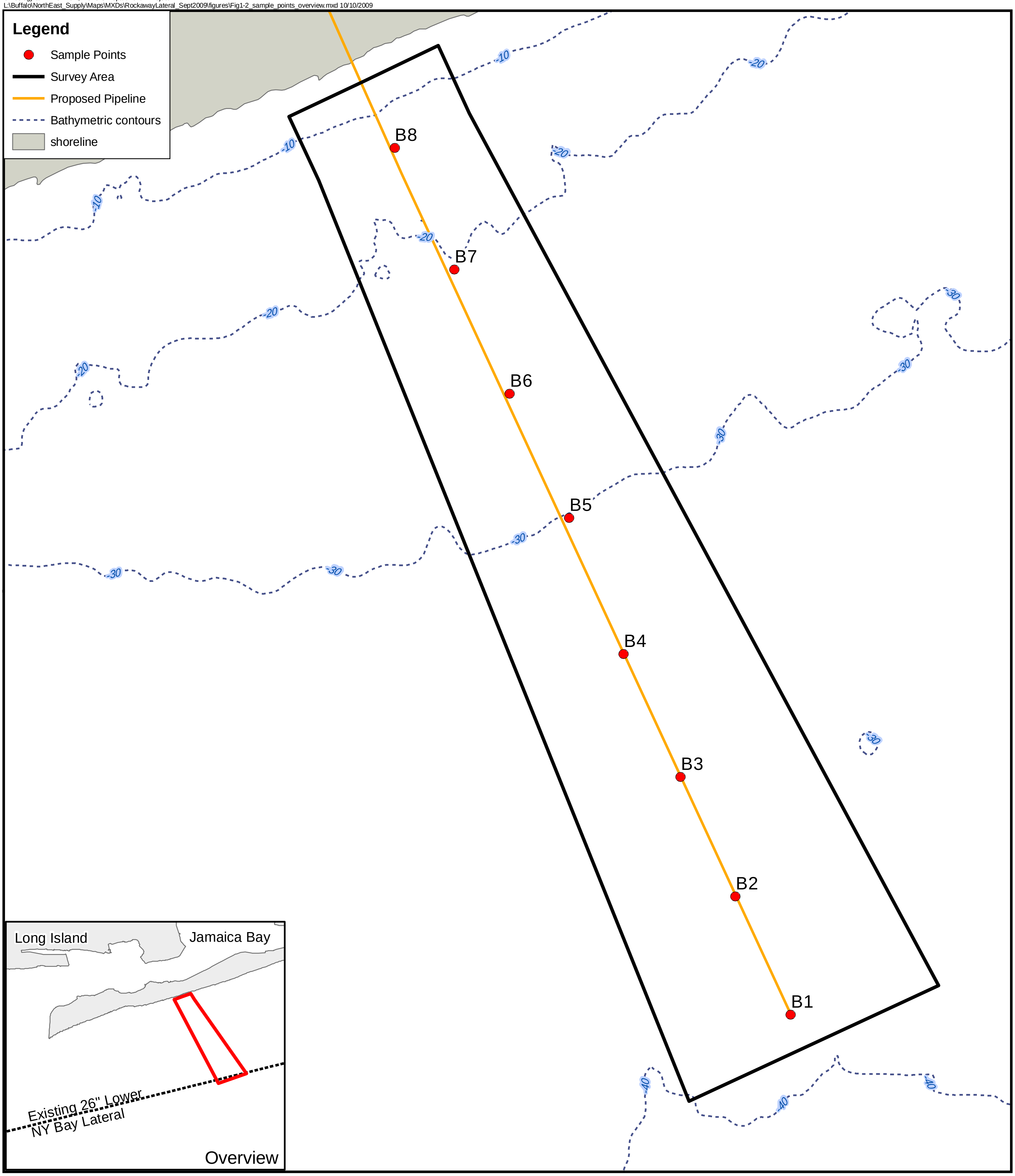



**Figure 1-1**
**Rockaway Delivery Lateral Project Location**
**Lower New York Bay**



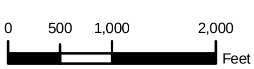
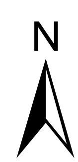




**Figure 1-2**
**Sediment and Water Quality Sampling Locations**
**Summer 2009 Field Survey**



# 2 Sediment Sampling Results

The sediment sampling plan developed to evaluate the site-specific sediment conditions along the proposed pipeline route was designed specifically to address the New York State Department of Environmental Conservation's (NYSDEC's), Technical and Operational Guidance Series (TOGS) 5.1.9 for In-Water and Riparian Management of Sediment and Dredged Material (November 2004). The plan includes analysis of several contaminants at a minimum interval of one sediment sample per one-half mile along the centerline of the proposed pipeline route (see Figure 1-2). Sediment sampling was performed through a coring operation in which a 10-foot sediment core was collected from each sampling location using a vibracore unit mounted on the survey vessel. Once retrieved, the sediment core soil types were classified, and sediment samples were collected from the core and shipped to a laboratory for chemical analysis. Each core was separated into four increments (depending on the depth of the sample), with approximate intervals of 0 to 1 foot, 1 to 4 feet, 4 to 7 feet, and 7 to 10 feet. Due to poor sample retention as a result of a sandy substrate, only three core fractions were collected from Station 3, resulting in a total of 31 samples. The tests performed, method, and quantities of samples collected are summarized in Table 2-1. Upon completion of the analyses, positive results were evaluated and compared to the NYSDEC TOGS criteria (see Table 2-2). The results are discussed below, and the complete analytical results are provided in Appendix B.

### Sediment Physical Parameters

At each sampling location, the sediment samples were measured for salinity, pH, and total organic carbon (TOC). Sediment samples were collected at eight sampling locations along the proposed pipeline route and sent for laboratory investigation of the aforementioned physical parameters. The laboratory analyses of the samples resulted in an average pH value of 7.81 ± 0.24 across all sampling locations, with a minimum of 7.20 and a maximum of 8.10. This range of pH values falls within the typical pH range in the area. TOC, measured in percent dry weight (mean = 0.074 % dry weight ± 0.038), and salinity (mean = 5.72 ppt ± 0.68) measurements also fell within typical ranges for the area.

**Table 2-1 Summary of Sediment Chemical Analyses**

| Test Description | EPA Method Number | Number of Samples Collected* |
|---|---|---|
| Arsenic as TAL Metals | EPA 6010B | 31 |
| Cadmium as TAL Metals | EPA 6010B | 31 |
| Copper as TAL Metals | EPA 6010B | 31 |
| Lead as TAL Metals | EPA 6010B | 31 |
| Mercury | EPA 6010B | 31 |
| Benzene | EPA 8021B or 8260B | 31 |
| Total BTX | EPA 8021B or 8260B | 31 |
| Total PAHs (sum of Target Compound List PAH) | EPA 8270C | 31 |
| Sum of DDT+DDE+DDD | EPA 8081A | 31 |
| Mirex | EPA 8081A | 31 |
| Chlordane | EPA 8081A | 31 |
| Dieldrin | EPA 8081A | 31 |
| PCBs (sum of aroclors) | EPA 8082 | 31 |
| Total Organic Carbon | Lloyd Kahn | 31 |
| pH | | 31 |
| Salinity | EPA 9045C | 31 |

* = Only 3 core fractions (to a depth of 6.5 feet) were collected from Station 3 due to the sandy substrate

### Metals
Each sediment sample was analyzed for five metals listed on the Target Analyte List (TAL): arsenic, cadmium, copper, lead, and mercury. The results of the analyses for these metals, along with the other chemicals analyzed for this report, are summarized in Table 2-1. Positive results were obtained for all of these metals in at least one sample; however, none of the values exceeded their respective TOGS criterion.

### Semi-Volatile Organic Compounds (SVOCs)
While positive results were obtained for fourteen SVOCs, including total polycyclic aromatic hydrocarbons (PAHs), none of the resultant values exceeded the corresponding TOGS compound levels.

### Pesticides
Pesticides were not detected in any sediment samples collected along the proposed pipeline route.

### Polychlorinated Biphenyls (PCBs)
PCBs were not detected in any sediment samples collected along the proposed pipeline route.

**Table 2-2 Summary of Positive Analytical Results for Sediment Samples, July 2009**

| Analyte | Screening Criteria (1) | Screening Criteria (2) | Sample ID: | 01-D0-1E | 01-D1-4E | 01-D4-7E | 01-D7-8.1E | 02-D0-1E | 02-D1-1E | 02-D4-7E | 02-D7-8.0E | 03-D0-1E | 03-D1-4E | 03-D4-7E | 03-D4-7E | 04-D0-1E | 04-D1-4E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Volatiles by 8260B (mg/kg)** | | | | | | | | | | | | | | | | | |
| Benzene | 2370 | 644 | | 2.49 U | 2.46 U | 2.48 U | 2.36 U | 2.43 U | 2.42 U | 2.58 U | 2.52 U | 2.42 U | 2.4 U | 2.41 U | 2.27 U | 2.52 U | 2.46 U |
| p/m-Xylene | 19171 | 2117 | | 4.98 U | 4.91 U | 4.96 U | 4.71 U | 4.86 U | 4.84 U | 5.17 U | 5.03 U | 4.84 U | 4.8 U | 4.82 U | 4.54 U | 5.04 U | 4.92 U |
| o-Xylene | 19171 | 2117 | | 2.49 U | 2.46 U | 2.48 U | 2.36 U | 2.43 U | 2.42 U | 2.58 U | 2.52 U | 2.42 U | 2.4 U | 2.41 U | 2.27 U | 2.52 U | 2.46 U |
| Toluene | 5408 | 1128 | | 2.49 U | 2.46 U | 2.48 U | 2.36 U | 2.43 U | 2.42 U | 2.58 U | 2.52 U | 2.42 U | 2.4 U | 2.41 U | 2.27 U | 2.52 U | 2.46 U |
| Total BTX | 960 | 960 | | 12.5 U | 12.3 U | 12.4 U | 11.8 U | 12.2 U | 12.1 U | 12.9 U | 12.6 U | 12.1 U | 12 U | 12.05 U | 11.35 U | 12.6 U | 12.3 U |
| **Semivolatiles by 8270D (mg/kg)** | | | | | | | | | | | | | | | | | |
| 2-Chloronaphthalene | N/A | N/A | | 4.39 U | 4.51 U | 2.97 U | 2.9 U | 2.99 U | 2.87 U | 3.05 U | 2.96 U | 4.32 U | 4.39 U | 4.5 U | 4.19 U | 4.69 U | 4.68 U |
| 2-Methylnaphthalene | 6996 | 782 | | 4.39 U | 4.51 U | 2.97 U | 2.9 U | 2.99 U | 2.87 U | 3.05 U | 2.96 U | 4.32 U | 4.39 U | 4.5 U | 4.19 U | 4.69 U | 4.68 U |
| Acenaphthene | N/A | N/A | | 4.39 U | 4.51 U | 2.97 U | 2.9 U | 2.99 U | 2.87 U | 3.05 U | 2.96 U | 4.32 U | 4.39 U | 4.5 U | 4.19 U | 4.69 U | 4.68 U |
| Acenaphthylene | N/A | N/A | | 4.39 U | 4.51 U | 2.97 U | 2.9 U | 2.99 U | 2.87 U | 3.05 U | 2.96 U | 4.32 U | 4.39 U | 4.5 U | 4.19 U | 4.69 U | 4.68 U |
| Anthracene | 22692 | 2462 | | 4.39 U | 4.51 U | 2.97 U | 2.9 U | 2.99 U | 2.87 U | 3.05 U | 2.96 U | 4.32 U | 4.39 U | 4.5 U | 4.19 U | 5.32 | 4.68 U |
| Benz(a)anthracene | 2163 | 276 | | 4.39 U | 4.51 U | 2.97 U | 2.9 U | 2.99 U | 2.87 U | 3.05 U | 2.96 U | 4.79 | 4.39 U | 4.5 U | 4.19 U | 4.69 U | 4.68 U |
| Benzo(a)pyrene | N/A | N/A | | 4.39 U | 4.51 U | 2.97 U | 2.9 U | 2.99 U | 2.87 U | 3.05 U | 2.96 U | 12.9 | 4.39 U | 4.5 U | 4.19 U | 6.27 | 4.68 U |
| Benzo(b)fluoranthene | N/A | N/A | | 4.39 U | 4.51 U | 2.97 U | 2.9 U | 2.99 U | 2.87 U | 3.05 U | 2.96 U | 10.9 | 4.39 U | 4.5 U | 4.19 U | 13.1 | 4.68 U |
| Benzo(ghi)perylene | N/A | N/A | | 4.39 U | 4.51 U | 2.97 U | 2.9 U | 2.99 U | 2.87 U | 3.05 U | 2.96 U | 62.8 | 17.3 | 13.5 U | 12.6 U | 13.7 U | 14 U |
| Benzo(k)fluoranthene | N/A | N/A | | 4.39 U | 4.51 U | 2.97 U | 2.9 U | 2.99 U | 2.87 U | 3.05 U | 2.96 U | 13.5 | 4.66 | 4.5 U | 4.19 U | 16.5 | 4.68 U |
| Chrysene | N/A | N/A | | 4.39 U | 4.51 U | 2.97 U | 2.9 U | 2.99 U | 2.87 U | 3.05 U | 2.96 U | 7.04 | 4.39 U | 4.5 U | 4.19 U | 6.05 | 4.68 U |
| Dibenz(a,h)anthracene | N/A | N/A | | 4.39 U | 4.51 U | 2.97 U | 2.9 U | 2.99 U | 2.87 U | 3.05 U | 2.96 U | 78.5 | 26.6 | 13.5 U | 12.6 U | 13.7 U | 14 U |
| Fluoranthene | N/A | 23474 | | 4.39 U | 4.51 U | 2.97 U | 2.9 U | 2.99 U | 2.87 U | 3.05 U | 2.96 U | 4.32 U | 4.39 U | 4.5 U | 4.19 U | 6.64 | 4.68 U |
| Fluorene | N/A | 184 | | 4.39 U | 4.51 U | 2.97 U | 2.9 U | 2.99 U | 2.87 U | 3.05 U | 2.96 U | 4.32 U | 4.39 U | 4.5 U | 4.19 U | 4.69 U | 4.68 U |
| Indeno(1,2,3-cd)pyrene | N/A | N/A | | 4.39 U | 4.51 U | 2.97 U | 2.9 U | 2.99 U | 2.87 U | 3.05 U | 2.96 U | 71.7 | 22.6 | 13.5 U | 12.6 U | 13.7 U | 14 U |
| Naphthalene | 5938 | 690 | | 4.39 U | 4.51 U | 2.97 U | 2.9 U | 2.99 U | 3.56 | 3.41 | 2.96 U | 4.32 U | 4.39 U | 4.5 U | 4.19 U | 4.69 U | 4.68 U |
| Phenanthrene | N/A | 2762 | | 4.39 U | 4.51 U | 2.97 U | 2.9 U | 2.99 U | 2.87 U | 3.05 U | 2.96 U | 4.32 U | 4.39 U | 4.5 U | 4.19 U | 5.02 | 4.68 U |
| Pyrene | 201948 | 22116 | | 4.39 U | 4.51 U | 2.97 U | 2.9 U | 2.99 U | 2.87 U | 3.05 U | 2.96 U | 4.32 U | 4.39 U | 4.5 U | 4.19 U | 9.96 | 4.68 U |
| Total PAH | 4000 | 4000 | | 79.0 U | 81.2 U | 53.5 U | 52.2 U | 53.8 U | 52.34 | 55.3 | 53.3 U | 305.33 | 132.62 | 108 U | 100.65 U | 142.79 | 112.2 U |
| **Pesticides by 8081A (mg/kg)** | | | | | | | | | | | | | | | | | |
| 4,4'-DDD | 25315 | N/A | | 0.22 U | 0.225 U | 0.148 U | 0.145 U | 0.149 U | 0.144 U | 0.152 U | 0.148 U | 0.216 U | 0.22 U | 0.225 U | 0.209 U | 0.234 U | 0.234 U |
| 4,4'-DDE | 25315 | N/A | | 0.22 U | 0.225 U | 0.148 U | 0.145 U | 0.149 U | 0.144 U | 0.152 U | 0.148 U | 0.216 U | 0.22 U | 0.225 U | 0.209 U | 0.234 U | 0.234 U |
| 4,4'-DDT | 25315 | 23 | | 0.22 U | 0.225 U | 0.148 U | 0.145 U | 0.149 U | 0.144 U | 0.152 U | 0.148 U | 0.216 U | 0.22 U | 0.225 U | 0.209 U | 0.234 U | 0.234 U |
| Sum of DDT+DDE+DDD | 25315 | 23 | | 0.66 U | 0.675 U | 0.444 U | 0.435 U | 0.447 U | 0.432 U | 0.456 U | 0.444 U | 0.648 U | 0.66 U | 0.675 U | 0.627 U | 0.702 U | 0.702 U |
| Technical Chlordane | 32 | 0.69 | | 11 U | 11.3 U | 7.42 U | 7.26 U | 7.47 U | 7.18 U | 7.62 U | 7.62 U | 10.8 U | 11 U | 11.2 U | 10.5 U | 11.7 U | 11.7 U |
| Dieldrin | N/A | 391 | | 0.22 U | 0.225 U | 0.148 U | 0.145 U | 0.149 U | 0.144 U | 0.152 U | 0.148 U | 0.216 U | 0.22 U | 0.225 U | 0.209 U | 0.234 U | 0.234 U |
| Mirex | N/A | 16 | | 0.22 U | 0.225 U | 0.148 U | 0.145 U | 0.149 U | 0.144 U | 0.152 U | 0.148 U | 0.216 U | 0.22 U | 0.225 U | 0.209 U | 0.234 U | 0.234 U |
| **PCBs by 8082 (mg/kg)** | | | | | | | | | | | | | | | | | |
| Aroclor 1016 | 63537 | 444 | | 9.45 U | 8.9 U | 6.01 U | 5.97 U | 5.98 U | 5.86 U | 5.97 U | 6.08 U | 7.76 U | 7.61 U | 7.49 U | 7.25 U | 5.79 U | 7.62 U |
| Aroclor 1221 | 63537 | 444 | | 9.45 U | 8.9 U | 6.01 U | 5.97 U | 5.98 U | 5.86 U | 5.97 U | 6.08 U | 7.76 U | 7.61 U | 7.49 U | 7.25 U | 5.79 U | 7.62 U |
| Aroclor 1232 | 63537 | 444 | | 9.45 U | 8.9 U | 6.01 U | 5.97 U | 5.98 U | 5.86 U | 5.97 U | 6.08 U | 7.76 U | 7.61 U | 7.49 U | 7.25 U | 5.79 U | 7.62 U |
| Aroclor 1242 | 63537 | 444 | | 9.45 U | 8.9 U | 6.01 U | 5.97 U | 5.98 U | 5.86 U | 5.97 U | 6.08 U | 7.76 U | 7.61 U | 7.49 U | 7.25 U | 5.79 U | 7.62 U |
| Aroclor 1248 | 63537 | 444 | | 9.45 U | 8.9 U | 6.01 U | 5.97 U | 5.98 U | 5.86 U | 5.97 U | 6.08 U | 7.76 U | 7.61 U | 7.49 U | 7.25 U | 5.79 U | 7.62 U |
| Aroclor 1254 | 63537 | 444 | | 9.45 U | 8.9 U | 6.01 U | 5.97 U | 5.98 U | 5.86 U | 5.97 U | 6.08 U | 7.76 U | 7.61 U | 7.49 U | 7.25 U | 5.79 U | 7.62 U |
| Aroclor 1260 | 63537 | 444 | | 9.45 U | 8.9 U | 6.01 U | 5.97 U | 5.98 U | 5.86 U | 5.97 U | 6.08 U | 7.76 U | 7.61 U | 7.49 U | 7.25 U | 5.79 U | 7.62 U |
| Total Aroclor | 63537 | 444 | | 66.2 U | 62.3 U | 42.1 U | 41.8 U | 41.9 U | 41.0 U | 41.8 U | 42.6 U | 54.32 U | 53.27 U | 52.43 U | 50.75 U | 40.53 U | 53.34 U |
| **Metals by 6010B (mg/kg)** | | | | | | | | | | | | | | | | | |
| Arsenic | 6 | 6 | | 2.41 | 2.64 | 1.79 | 1.41 | 2.18 | 2.57 | 1.83 | 1.84 | 2.38 | 3.04 | 2.18 | 2.67 | 1.85 | 3.88 |
| Cadmium | 0.6 | 0.6 | | 0.067 | 0.04 U | 0.041 U | 0.041 U | 0.041 U | 0.041 U | 0.046 | 0.04 U | 0.039 U | 0.04 U | 0.04 U | 0.038 U | 0.041 U | 0.039 U |
| Copper | 16 | 16 | | 1.47 | 1.87 | 1.49 | 1.3 | 1.17 | 2.05 | 1.58 | 1.53 | 1.37 | 1.28 | 1.42 | 4.09 | 7.2 | 1.55 |
| Lead | 31 | 31 | | 3.83 | 1.81 | 1.9 | 1.91 | 2.69 | 2.07 | 2.2 | 2.06 | 3.04 | 1.71 | 1.88 | 2.3 | 9.2 | 3.42 |
| Mercury | 0.15 | 0.15 | | 0.015 U | 0.015 U | 0.015 U | 0.015 U | 0.015 U | 0.015 U | 0.016 U | 0.015 U | 0.015 U | 0.015 U | 0.015 U | 0.014 U | 0.026 | 0.015 U |
| % Moisture | N/A | N/A | | 20.0% | 18.6% | 20.3% | 20.4% | 20.3% | 20.0% | 22.6% | 20.8% | 17.4% | 16.8% | 18.7% | 14.3% | 21.0% | 19.3% |

| Analyte | Screening Criteria (1) | Screening Criteria (2) | 04-D4-6.5E | 05-D0-1E | 05-D1-4E | 05-D4-7E | 05-D7-7.1E | 06-D0-1E | 06D1-4E | 06-D4-7E | 06-D7-7.9E | 07-D0-1E | 07-D1-4E | 07-D4-7 | 07-D7-9.9E | 08-D0-1E | 08-D1-4E | 08-D4-7E | 08-D7-9.9E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Volatiles by 8260B (mg/kg)** | | | | | | | | | | | | | | | | | | | |
| Benzene | 2370 | 644 | 2.33 U | 2.5 U | 2.34 U | 2.44 U | 2.24 U | 2.55 U | 2.5 U | 2.45 U | 2.41 U | 2.56 U | 2.46 U | 2.59 U | 2.51 U | 2.41 U | 2.5 U | 2.48 U | 2.51 U |
| p/m-Xylene | 19171 | 2117 | 4.65 U | 5.01 U | 4.68 U | 4.87 U | 4.47 U | 5.1 U | 5 U | 4.91 U | 4.81 U | 5.12 U | 4.93 U | 5.18 U | 5.02 U | 4.82 U | 5.01 U | 4.96 U | 5.02 U |
| o-Xylene | 19171 | 2117 | 2.33 U | 2.5 U | 2.34 U | 2.44 U | 2.24 U | 2.55 U | 2.5 U | 2.45 U | 2.41 U | 2.56 U | 2.46 U | 2.59 U | 2.51 U | 2.41 U | 2.5 U | 2.48 U | 2.51 U |
| Toluene | 5408 | 1128 | 2.33 U | 2.5 U | 2.34 U | 2.44 U | 2.24 U | 2.55 U | 2.5 U | 2.45 U | 2.41 U | 2.56 U | 2.46 U | 2.59 U | 2.51 U | 2.41 U | 2.5 U | 2.48 U | 2.51 U |
| Total BTX | 960 | 960 | 11.64 U | 12.51 U | 11.7 U | 12.19 U | 11.19 U | 12.75 U | 12.5 U | 12.26 U | 12.04 U | 12.8 U | 12.31 U | 12.95 U | 12.55 U | 12.05 U | 12.51 U | 12.4 U | 12.55 U |
| **Semivolatiles by 8270D (mg/kg)** | | | | | | | | | | | | | | | | | | | |
| 2-Chloronaphthalene | N/A | N/A | 4.4 U | 3.02 U | 4.42 U | 4.34 U | 3.97 U | 3.02 U | 2.95 U | 3.82 U | 3.83 U | 3.06 U | 2.93 U | 3.07 U | 2.97 U | 3.86 U | 3.02 U | 3.95 U | 2.95 U |
| 2-Methylnaphthalene | 6996 | 782 | 4.4 U | 3.02 U | 4.42 U | 4.34 U | 3.97 U | 3.02 U | 2.95 U | 3.82 U | 3.83 U | 3.06 U | 2.93 U | 3.07 U | 2.97 U | 3.86 U | 3.02 U | 3.95 U | 2.95 U |
| Acenaphthene | N/A | N/A | 4.4 U | 3.02 U | 4.42 U | 4.34 U | 3.97 U | 3.02 U | 2.95 U | 3.82 U | 3.83 U | 3.06 U | 2.93 U | 3.07 U | 2.97 U | 3.86 U | 3.02 U | 3.95 U | 2.95 U |
| Acenaphthylene | N/A | N/A | 4.4 U | 3.02 U | 4.42 U | 4.34 U | 3.97 U | 3.02 U | 2.95 U | 3.82 U | 3.83 U | 3.06 U | 2.93 U | 3.07 U | 2.97 U | 3.86 U | 3.02 U | 3.95 U | 2.95 U |
| Anthracene | 22692 | 2462 | 4.4 U | 3.02 U | 4.42 U | 4.34 U | 3.97 U | 3.02 U | 2.95 U | 3.82 U | 3.83 U | 3.06 U | 2.93 U | 3.07 U | 2.97 U | 3.86 U | 3.02 U | 3.95 U | 2.95 U |
| Benz(a)anthracene | 2163 | 276 | 4.4 U | 3.02 U | 4.42 U | 4.34 U | 3.97 U | 3.02 U | 2.95 U | 3.82 U | 3.83 U | 3.06 U | 2.93 U | 3.07 U | 2.97 U | 3.86 U | 3.02 U | 3.95 U | 2.95 U |
| Benzo(a)pyrene | N/A | N/A | 15.1 | 3.61 | 4.42 U | 4.34 U | 3.97 U | 3.02 U | 2.95 U | 3.82 U | 3.83 U | 3.06 U | 2.93 U | 3.07 U | 2.97 U | 3.86 U | 3.02 U | 4.14 | 2.95 U |
| Benzo(b)fluoranthene | N/A | N/A | 9.26 | 3.02 U | 4.42 U | 4.34 U | 3.97 U | 3.02 U | 2.95 U | 3.82 U | 3.83 U | 3.06 U | 2.93 U | 3.07 U | 2.97 U | 3.86 U | 3.02 U | 3.95 U | 2.95 U |
| Benzo(ghi)perylene | N/A | N/A | 53.7 | 3.02 U | 4.42 U | 4.34 U | 3.97 U | 3.02 U | 2.95 U | 3.82 U | 3.83 U | 3.06 U | 2.93 U | 3.07 U | 2.97 U | 3.86 U | 3.02 U | 8.21 | 2.95 U |
| Benzo(k)fluoranthene | N/A | N/A | 13.7 | 3.02 U | 4.42 U | 4.34 U | 3.97 U | 3.02 U | 2.95 U | 3.82 U | 3.83 U | 3.06 U | 2.93 U | 3.07 U | 2.97 U | 3.86 U | 3.02 U | 3.95 U | 2.95 U |
| Chrysene | N/A | N/A | 7.18 | 3.02 U | 4.42 U | 4.34 U | 3.97 U | 3.02 U | 2.95 U | 3.82 U | 3.83 U | 3.06 U | 2.93 U | 3.07 U | 2.97 U | 3.86 U | 3.02 U | 3.95 U | 2.95 U |
| Dibenz(a,h)anthracene | N/A | N/A | 67 | 3.02 U | 4.42 U | 4.34 U | 3.97 U | 3.02 U | 2.95 U | 3.82 U | 3.83 U | 3.06 U | 2.93 U | 3.07 U | 2.97 U | 3.86 U | 3.02 U | 7.28 | 2.95 U |
| Fluoranthene | N/A | 23474 | 4.4 U | 3.02 U | 4.42 U | 4.34 U | 3.97 U | 3.02 U | 2.95 U | 3.82 U | 3.83 U | 3.06 U | 2.93 U | 3.07 U | 2.97 U | 3.86 U | 3.02 U | 3.95 U | 2.95 U |
| Fluorene | N/A | 184 | 4.4 U | 3.02 U | 4.42 U | 4.34 U | 3.97 U | 3.02 U | 2.95 U | 3.82 U | 3.83 U | 3.06 U | 2.93 U | 3.07 U | 2.97 U | 3.86 U | 3.02 U | 3.95 U | 2.95 U |
| Indeno(1,2,3-cd)pyrene | N/A | N/A | 54.3 | 3.02 U | 4.42 U | 4.34 U | 3.97 U | 3.02 U | 2.95 U | 3.82 U | 3.83 U | 3.06 U | 2.93 U | 3.07 U | 2.97 U | 3.86 U | 3.02 U | 7.52 | 2.95 U |
| Naphthalene | 5938 | 690 | 4.4 U | 3.02 U | 5.74 | 4.34 U | 3.97 U | 3.02 U | 2.95 U | 3.82 U | 3.83 U | 3.06 U | 2.93 U | 3.07 U | 2.97 U | 3.86 U | 3.02 U | 3.95 U | 2.95 U |
| Phenanthrene | N/A | 2762 | 4.4 U | 3.02 U | 4.42 U | 4.34 U | 3.97 U | 3.02 U | 2.95 U | 3.82 U | 3.83 U | 3.06 U | 2.93 U | 3.07 U | 2.97 U | 3.86 U | 3.02 U | 3.95 U | 2.95 U |
| Pyrene | 201948 | 22116 | 4.4 U | 3.02 U | 4.42 U | 4.34 U | 3.97 U | 3.02 U | 2.95 U | 3.82 U | 3.83 U | 3.06 U | 2.93 U | 3.07 U | 2.97 U | 3.86 U | 3.02 U | 3.95 U | 2.95 U |
| Total PAH | 4000 | 4000 | 268.64 | 54.95 | 80.88 | 78.12 U | 71.46 U | 54.36 U | 53.1 U | 68.76 U | 68.94 U | 55.08 U | 52.74 U | 55.26 U | 53.46 U | 69.48 U | 54.36 U | 82.45 | 53.1 U |
| **Pesticides by 8081A (mg/kg)** | | | | | | | | | | | | | | | | | | | |
| 4,4'-DDD | 25315 | N/A | 0.22 U | 0.151 U | 0.221 U | 0.217 U | 0.199 U | 0.151 U | 0.147 U | 0.191 U | 0.192 U | 0.153 U | 0.146 U | 0.154 U | 0.148 U | 0.193 U | 0.151 U | 0.197 U | 0.15 U |
| 4,4'-DDE | 25315 | N/A | 0.22 U | 0.151 U | 0.221 U | 0.217 U | 0.199 U | 0.151 U | 0.147 U | 0.191 U | 0.192 U | 0.153 U | 0.146 U | 0.154 U | 0.148 U | 0.193 U | 0.151 U | 0.197 U | 0.15 U |
| 4,4'-DDT | 25315 | 23 | 0.22 U | 0.151 U | 0.221 U | 0.217 U | 0.199 U | 0.151 U | 0.147 U | 0.191 U | 0.192 U | 0.153 U | 0.146 U | 0.154 U | 0.148 U | 0.193 U | 0.151 U | 0.197 U | 0.15 U |
| Sum of DDT+DDE+DDD | 25315 | 23 | 0.66 U | 0.453 U | 0.663 U | 0.651 U | 0.597 U | 0.453 U | 0.441 U | 0.573 U | 0.576 U | 0.459 U | 0.438 U | 0.462 U | 0.444 U | 0.579 U | 0.453 U | 0.591 U | 0.45 U |
| Technical Chlordane | 32 | 0.69 | 11 U | 7.55 U | 11 U | 10.8 U | 9.93 U | 7.56 U | 7.37 U | 9.55 U | 9.58 U | 7.66 U | 7.33 U | 7.68 U | 7.43 U | 9.65 U | 7.55 U | 9.87 U | 7.48 U |
| Dieldrin | N/A | 391 | 0.22 U | 0.151 U | 0.221 U | 0.217 U | 0.199 U | 0.151 U | 0.147 U | 0.191 U | 0.192 U | 0.153 U | 0.146 U | 0.154 U | 0.148 U | 0.193 U | 0.151 U | 0.197 U | 0.15 U |
| Mirex | N/A | 16 | 0.22 U | 0.151 U | 0.221 U | 0.217 U | 0.199 U | 0.151 U | 0.147 U | 0.191 U | 0.192 U | 0.153 U | 0.146 U | 0.154 U | 0.148 U | 0.193 U | 0.151 U | 0.197 U | 0.15 U |
| **PCBs by 8082 (mg/kg)** | | | | | | | | | | | | | | | | | | | |
| Aroclor 1016 | 63537 | 444 | 7.1 U | 5.98 U | 8.51 U | 9.43 U | 8.22 U | 6.28 U | 6.09 U | 7.87 U | 7.71 U | 6.21 U | 5.88 U | 6.14 U | 6.06 U | 7.78 U | 6 U | 7.7 U | 6.13 U |
| Aroclor 1221 | 63537 | 444 | 7.1 U | 5.98 U | 8.51 U | 9.43 U | 8.22 U | 6.28 U | 6.09 U | 7.87 U | 7.71 U | 6.21 U | 5.88 U | 6.14 U | 6.06 U | 7.78 U | 6 U | 7.7 U | 6.13 U |
| Aroclor 1232 | 63537 | 444 | 7.1 U | 5.98 U | 8.51 U | 9.43 U | 8.22 U | 6.28 U | 6.09 U | 7.87 U | 7.71 U | 6.21 U | 5.88 U | 6.14 U | 6.06 U | 7.78 U | 6 U | 7.7 U | 6.13 U |
| Aroclor 1242 | 63537 | 444 | 7.1 U | 5.98 U | 8.51 U | 9.43 U | 8.22 U | 6.28 U | 6.09 U | 7.87 U | 7.71 U | 6.21 U | 5.88 U | 6.14 U | 6.06 U | 7.78 U | 6 U | 7.7 U | 6.13 U |
| Aroclor 1248 | 63537 | 444 | 7.1 U | 5.98 U | 8.51 U | 9.43 U | 8.22 U | 6.28 U | 6.09 U | 7.87 U | 7.71 U | 6.21 U | 5.88 U | 6.14 U | 6.06 U | 7.78 U | 6 U | 7.7 U | 6.13 U |
| Aroclor 1254 | 63537 | 444 | 7.1 U | 5.98 U | 8.51 U | 9.43 U | 8.22 U | 6.28 U | 6.09 U | 7.87 U | 7.71 U | 6.21 U | 5.88 U | 6.14 U | 6.06 U | 7.78 U | 6 U | 7.7 U | 6.13 U |
| Aroclor 1260 | 63537 | 444 | 7.1 U | 5.98 U | 8.51 U | 9.43 U | 8.22 U | 6.28 U | 6.09 U | 7.87 U | 7.71 U | 6.21 U | 5.88 U | 6.14 U | 6.06 U | 7.78 U | 6 U | 7.7 U | 6.13 U |
| Total Aroclor | 63537 | 444 | 49.7 U | 41.86 U | 59.57 U | 66.01 U | 57.54 U | 21.98 U | 21.315 U | 27.545 U | 26.985 U | 21.735 U | 20.58 U | 21.49 U | 21.21 U | 27.23 U | 21 U | 26.95 U | 21.455 U |
| **Metals by 6010B (mg/kg)** | | | | | | | | | | | | | | | | | | | |
| Arsenic | 6 | 6 | 2.64 | 1.59 | 1.84 | 3.14 | 2.98 | 0.952 | 1.04 | 1.04 | 1.68 | 0.749 | 0.795 | 1.13 | 1.59 | 0.804 | 0.831 | 0.868 | 1.9 |
| Cadmium | 0.6 | 0.6 | 0.038 U | 0.042 U | 0.039 U | 0.048 | 0.038 U | 0.121 | 0.041 U | 0.041 U | 0.04 U | 0.041 U | 0.04 U | 0.042 U | 0.041 U | 0.041 U | 0.04 U | 0.083 | 0.039 U |
| Copper | 16 | 16 | 2.69 | 1.03 | 1.08 | 3.16 | 2.21 | 0.847 | 0.714 | 0.913 | 0.986 | 0.646 | 0.81 | 0.812 | 1.84 | 1.33 | 0.604 | 3.38 | 2.04 |
| Lead | 31 | 31 | 1.95 | 2.66 | 1.71 | 1.89 | 1.53 | 2.36 | 1.54 | 1.47 | 1.55 | 2.1 | 1.06 | 1.61 | 1.36 | 1.92 | 1.14 | 1.3 | 2.13 |
| Mercury | 0.15 | 0.15 | 0.015 U | 0.015 U | 0.015 U | 0.015 U | 0.014 U | 0.016 U | 0.015 U | 0.015 U | 0.015 U | 0.016 U | 0.015 U | 0.015 U | 0.015 U | 0.015 U | 0.015 U | 0.015 U | 0.016 U |
| % Moisture | N/A | N/A | 16.2% | 20.8% | 16.2% | 19.2% | 12.3% | 22.6% | 20.6% | 18.8% | 19.3% | 22.0% | 20.1% | 23.6% | 21.0% | 19.7% | 21.7% | 19.5% | 20.7% |

(1) - NYSDEC Technical Guidance for Screening Contaminated Sediments Benthic Aquatic Life Acute Toxicity

(2) - NYSDEC Technical Guidance for Screening Contaminated Sediments Benthic Aquatic Life Chronic Toxicity

Key:

mg/Kg = Milligrams per kilogram.

µg/Kg = Micrograms per kilogram.

U = Not detected at the reported value.

### Volatile Organic Compounds (VOCs)

All of the VOCs examined in the sediment analysis were found at levels below the minimum detectable quantity (MDQ). As such, it was determined that there are no VOCs in sediment that propose a potential hazard within the Project area.

### Dioxin

No dioxin analysis was performed due to the sandy composition of the sediments within the Project area.

# 3 Water Quality Sampling Results

The water quality of the Lower New York Bay is influenced by many physical factors, including physicochemical inputs and geographic characteristics. Water quality sampling was performed to obtain data regarding background conditions in the water column. The data were then compared to known water quality values for the Lower New York Bay, including parameters for physical, chemical, and biological components of the water column. Water quality sampling locations were collocated with the eight sediment sampling locations (see Figure 1-2), and collected during the same field effort. Water quality samples were collected from three different depths at each location (bottom, middle, and surface) to evaluate the physical quality of the water in the vicinity of the proposed pipeline route. The results for each sampling group (physical, chemical, and biological) are summarized below.

## 3.1 Physical Parameters of Water Quality

### Dissolved Oxygen (DO)

In the last few decades, the Lower New York Bay has experienced a favorable increase in the levels of dissolved oxygen. This can be attributed to various efforts to improve water quality through more stringent regulations on municipal and industrial discharges (O'Shea and Brosnan, 2000). Recent DO levels, as reported in the 2008 New York Harbor Water Quality Report, have illustrated averages between 7.80 mg/L in bottom waters to 8.30 mg/L in surface waters (NYCDEP 2008). Results of the data collected during this field effort confirmed DO levels in the survey area within this range and higher (mean = 8.40 mg/L; range = 7.90 to 9.10 mg/L).

### Temperature

The average temperature for water quality samples collected along the proposed pipeline was 18.90ºC ± 0.05 ºC. The water quality samples exhibited a range in temperature from 18.14ºC to 18.95 ºC.

### Turbidity

An analysis of turbidity, as well as total suspended solids (TSS), indicated minimal variation in these measurements along the pipeline route. The average turbidity measurement across all sampling locations (including all three sampling depths) was 2.5 Nephelometric Turbidity Units (NTU), with a range of 1.9 NTU to 3.4 NTU. TSS values in the Project area ranged from 8.00 mg/L to 83.00 mg/L, with an average of 47.58 mg/L ± 14.70 mg/L.

### pH

Data for pH was collected in conjunction with other water quality parameters using a Whale submersible pump along the proposed pipeline route. Analyses of the samples across all sampling locations and depths resulted in an average pH value of 8.24 ± 0.166, with a minimum of 7.60 and a maximum of 7.94. These values fall within typical pH levels in the area.

## 3.2 Chemical and Biological Water Quality

Chemical and biological water quality samples were collected in 1-liter volumes from each of the discrete depths at the eight sampling locations, with the exception of biological oxygen demand (BOD) samples, which were collected in 250-milliliter amber glass bottles to protect the integrity of the samples until analysis. Samples were sent to the laboratory on the same day as sample collection due to short holding times between collection and analysis. A summary of the water quality analyses performed is presented in Tables 3-1 and 3-2. The water quality sample results are presented in Table 3-3 and discussed below. The complete analytical results are presented in Appendix B.

**Table 3-1 Summary of Water Sample Analyses - Biological**

| Test Description | EPA Method Number | Number of Samples Collected |
|---|---|---|
| Total Suspended Solids | EPA 160.2 | 24 |
| Colloidal/Settleable Solids | EPA 160.5 | 24 |
| Fecal Coliform Bacteria | SM4221C | 24 |
| Total Coliform Bacteria | SM4221B | 24 |
| Biological oxygen demand | SM5210B | 24 |

**Table 3-2 Summary of Water Sample Analyses – Chemical**

| Test Description | EPA Method Number | Number of Samples Collected |
|---|---|---|
| Ammonia (as N) | EPA 350.3 | 24 |
| Chlorides | EPA 300 | 24 |
| Total Organic Nitrogen | SM4500-NC | 24 |
| Total Phosphorus | EPA 365.3 | 24 |
| Chemical Oxygen Demand | EPA 410.1 | 24 |

**Table 3-3 Summary of Positive Analytical Results for Water Quality Samples, July 2009**

| Analyte | Units | Screening Criteria [1] | Sample ID: | 01-DB-1W | 01-DM-1W | 01-DS-1W | 02-DB-2W | 02-DM-2W | 02-DS-2W | 03-DB-3W | 03-DM-3W | 03-DS-3W | 04-DB-4W | 04-DM-4W | 04-DS-4W | 05-DB-5W | 05-DM-5W | 05-DS-5W | 06-DB-6W | 06-DM-6W | 06-DS-6W | 07-DB-7W | 07-DM-7W | 07-DS-7W | 08-DB-7W | 08-DM-7W | 08-DS-7W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Anions (mg/L)** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Chloride | mg/L | NA | | 16500 | 16500 | 16000 | 16400 | 16200 | 16700 | 16300 | 16500 | 1600 | 16900 | 16500 | 16500 | 16000 | 15900 | 16000 | 16300 | 16400 | 16000 | 16400 | 16200 | 16500 | 16200 | 16300 | 16600 |
| **General Analytical (mg/L)** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ammonia-N | mg/L | NA | | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| Biochemical Oxygen Demand | mg/L | NA | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Chemical Oxygen Demand | mg/L | NA | | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| Fecal Coliform | organisms per 100 mL | NA | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Settleable Solids | mg/L | NA | | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| T. Kjeldahl Nitrogen | mg/L as N | NA | | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| Total Coliform | organisms per 100 mL | NA | | 20 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Total Organic Nitrogen | mg/L | NA | | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| Total Phosphorous | mg/L as P | NA | | 0.10 | 0.13 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.13 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| Total Suspended Solids | mg/L | NA | | 59 | 47 | 58 | 75 | 50 | 41 | 83 | 45 | 67 | 44 | 34 | 46 | 47 | 51 | 35 | 8 | 49 | 42 | 36 | 44 | 50 | 46 | 50 | 35 |

(1) - NYSDEC Technical Guidance for Screening Contaminated Sediments Benthic Aquatic Life Acute Toxicity

* Matrix interference due to high chloride content. No value provided.

Key:
mg/L = Milligrams per liter.

## Biological Parameters

Biological parameters are often evaluated to determine the baseline water quality of a given water body, since parameters such as biological oxygen demand (BOD) and Total Suspended Solids (TSS) may be affected by negative inputs such as raw sewage and other waste products. Water samples were collected and tested for the biological parameters identified in Table 3-1. The results for TSS, BOD, and colloidal/settleable solids all fell within the normal range for water quality.

In order to evaluate bacteria levels along the proposed pipeline route that may be indicative of increased sewage inputs or elevated nutrient inputs, Transco collected water quality samples for fecal coliforms and total coliform bacteria during the field effort. The results of the analyses indicated very low levels of fecal coliforms and total coliform units. Every sample had a level of 10 coliform units per 100 mL, except for one (20 coliform units per 100 mL), well below the NYCDEP standard of 2400 coliform units per 100 mL. The results of the laboratory analyses are presented in Appendix B.

## Chemical Parameters

Chemical parameters also are evaluated to determine the baseline water quality of a given water body, since parameters such as total phosphorus and nitrogen are often affected by negative inputs such as municipal runoff. Water samples were collected and tested for the chemical parameters identified in Table 3-2. The results of the chemical water quality analysis confirm that the water quality parameters along the proposed pipeline route fall in the range of the natural conditions present in the Lower New York Bay. Water quality in this area is generally not impacted by contaminant inputs from the surrounding coastlines.

The complete analytical results for all water quality samples are provided in Appendix B.

# 4 Benthic Community Analysis

As part of the field effort, a site-specific baseline benthic survey was conducted with the purpose of ascertaining the health of the existing benthic community along the proposed pipeline route and, in combination with the sediment chemical analysis, to assess the overall quality and potential impact from sediment disturbance during pipeline installation. Benthic community samples were collected at the 8 sediment and water quality stations along the proposed pipeline route using a Smith-MacIntyre grab sampler (see Figure 4-1). At each location, triplicate samples were collected with one located on the proposed pipeline centerline and two offset perpendicular to the centerline at a distance of approximately 200 feet. , Drop camera video was also collected at each sampling location for qualitative analysis of the benthic community. A remote operated vehicle (ROV) video investigation was also conducted to qualitatively analyze the benthic and epibenthic communities associated with targets identified through geophysical investigations.

Generally, the sediment type within the survey area is primarily sand with small amounts (less than 10%) of silt and clay. The benthic communities in the survey area are dominated by several burrowing polychaetes, amphipod and decapod crustaceans, and one bivalve species. For most samples, three species, the Atlantic surfclam (*Spisula solidissima*), the amphipod *Rhepoxynius epistomus*, and the polychaete *Nephtys incise*, comprised over 50% of the total individuals identified. Video observations identified egg casings of the gastropod *Lunatia* sp. on the substrate surface at most of the sampling stations. The greatest differences in species' composition were observed for stations close to shore (dominated by amphipods) versus those in deeper offshore waters (dominated by polychaetes and bivalves) (Table 4-1). Pagurid (hermit) crabs and floating algae were also observed, but are not considered in this evaluation of benthic communities. A complete list of the taxa collected at each station is provided in Appendix D, Benthic Identification Spreadsheets.

Diversity was assessed using Shannon's Diversity Index ($H^1$) at each station based on triplicate samples (see Figure 4-1). Diversity estimates were higher for samples further from the shoreline than those close to the shoreline (see Figure 4-1).

## Table 4-1 Benthic Data Results Summary for Proposed Pipeline Route, July 2009

| Measurement | B1W | B1C | B1E | Station 1 Average |
|---|---|---|---|---|
| Depth (ft) | 39.8 | 39.5 | 40.9 | 40.1 |
| Total # of Organisms Identified | 29 | 50 | 110 | 63 |
| Taxa Richness | 12 | 15 | 19 | 15 |
| Diversity ($H^1$) | 2.22 | 2.06 | 2.29 | 2.19 |
| Evenness | 2.06 | 1.75 | 1.79 | 1.87 |

Notes:
dominanat species = at least 50% of sample when totaled
*Paraonis sp., Nephtys incisa, Spisula solidissima, Oligochaeta*

| Measurement | B2W | B2C | B2E | Station 2 Average |
|---|---|---|---|---|
| Depth (ft) | 38.4 | 38.3 | 38.4 | 38.4 |
| Total # of Organisms Identified | 87 | 121 | 62 | 90 |
| Taxa Richness | 14 | 17 | 14 | 15 |
| Diversity ($H^1$) | 2.19 | 1.92 | 2.33 | 2.19 |
| Evenness | 1.91 | 1.56 | 2.03 | 1.84 |

Notes:
dominanat species = at least 50% of sample when totaled
*Nephtys incisa, Spisula solidissima, Rhepoxynius epistomus*

| Measurement | B3W | B3C | B3E | Station 3 Average |
|---|---|---|---|---|
| Depth (ft) | 37.3 | 37.9 | 37.3 | 37.5 |
| Total # of Organisms Identified | 141 | 137 | 127 | 135 |
| Taxa Richness | 16 | 18 | 17 | 17 |
| Diversity ($H^1$) | 2.37 | 2.18 | 1.90 | 2.15 |
| Evenness | 1.93 | 1.74 | 1.58 | 1.75 |

Notes:
dominanat species = at least 50% of sample when totaled
*Nephtys incisa, Spisula solidissima, Rhepoxynius epistomus*

| Measurement | B4W | B4C | B4E | Station 4 Average |
|---|---|---|---|---|
| Depth (ft) | 35.6 | 37.1 | 35.9 | 36.2 |
| Total # of Organisms Identified | 119 | 109 | 113 | 114 |
| Taxa Richness | 20 | 14 | 15 | 16 |
| Diversity ($H^1$) | 2.06 | 1.88 | 2.35 | 2.10 |
| Evenness | 1.75 | 1.64 | 1.81 | 1.73 |

Notes:
dominanat species = at least 50% of sample when totaled
*Spisula solidissima, Rhepoxynius epistomus, Nephtys incisa*

| Measurement | B5W | B5C | B5E | Station 5 Average |
|---|---|---|---|---|
| Depth (ft) | 33.4 | 34.2 | 33.5 | 33.7 |
| Total # of Organisms Identified | 225 | 167 | 158 | 183 |
| Taxa Richness | 17 | 18 | 18 | 18 |
| Diversity ($H^1$) | 2.38 | 2.34 | 2.41 | 2.38 |
| Evenness | 1.93 | 1.86 | 1.92 | 1.91 |

Notes:
dominanat species = at least 50% of sample when totaled
*Paraonis sp., Spisula solidissima, Tharyx sp., Oligochaeta*

## Table 4-1 Benthic Data Results Summary for Proposed Pipeline Route, July 2009

| Measurement | B6W | B6C | B6E | Station 6 Average |
|---|---|---|---|---|
| Depth (ft) | 36.4 | 27.7 | 27.6 | 30.6 |
| Total # of Organisms Identified | 208 | 226 | 218 | 217 |
| Taxa Richness | 19 | 17 | 19 | 18 |
| Diversity ($H^1$) | 1.74 | 1.78 | 2.01 | 1.84 |
| Evenness | 1.36 | 1.45 | 1.57 | 1.46 |

Notes:

dominanat species = at least 50% of sample when totaled

*Rhepoxynius epistomus, Tharyx sp.*

| Measurement | B7W | B7C | B7E | Station 7 Average |
|---|---|---|---|---|
| Depth (ft) | 25.2 | 25.1 | 25.4 | 25.2 |
| Total # of Organisms Identified | 123 | 143 | 160 | 142 |
| Taxa Richness | 9 | 6 | 11 | 9 |
| Diversity ($H^1$) | 1.23 | 0.42 | 1.30 | 0.98 |
| Evenness | 1.29 | 0.54 | 1.25 | 1.03 |

Notes:

dominanat species = at least 50% of sample when totaled

*Rhepoxynius epistomus*

| Measurement | B8W | B8C | B8E | Station 8 Average |
|---|---|---|---|---|
| Depth (ft) | 21.9 | 21.9 | 21.8 | 21.9 |
| Total # of Organisms Identified | 143 | 171 | 201 | 172 |
| Taxa Richness | 8 | 13 | 11 | 11 |
| Diversity ($H^1$) | 0.74 | 1.41 | 1.21 | 1.12 |
| Evenness | 0.82 | 1.27 | 1.16 | 1.08 |

Notes:

dominanat species = at least 50% of sample when totaled

*Rhepoxynius epistomus*

Inshore samples (Stations B-7 and B-8) had lower diversity estimates ($H^1 = 1.05 \pm 0.39$) compared to those further offshore (Stations B-1 through B-6; $H^1 = 2.13 \pm 0.22$). Diversity estimates did not appear to be affected by sediment type, as all stations had similar compositions of sand, silt and clay. Diversity appeared to be correlated with the depth at each collected sample, as locations in deeper areas had higher diversity estimates than those in shallower areas.

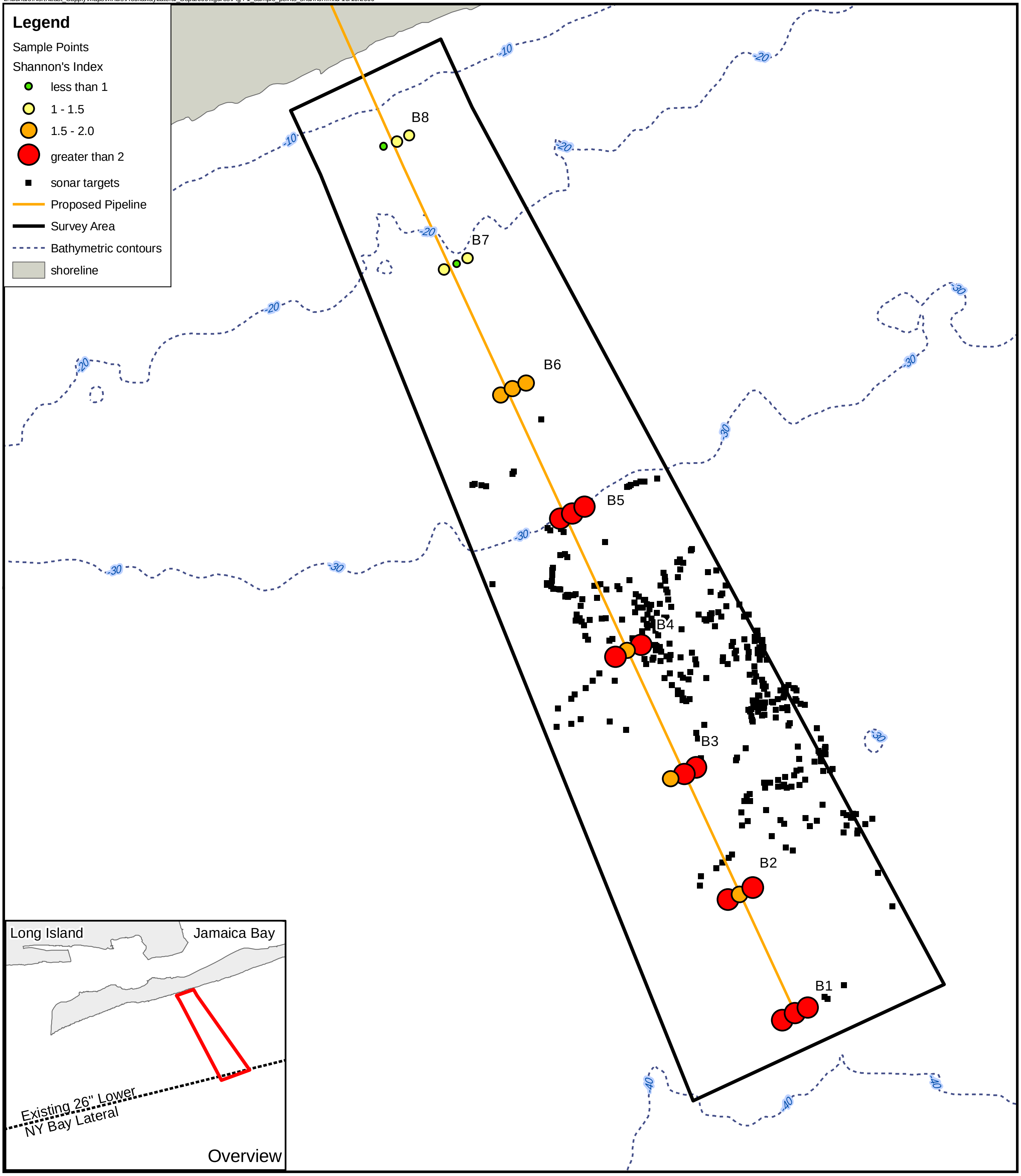
Based on the data collected, two general benthic communities were identified in the Project area (see Figure 4-2): a Nearshore Community and an Offshore Community. In addition, a third, epibenthic, community, the Anthropogenic Deposit Community, was identified during ROV investigations of 19 potential hard bottom sites identified during geophysical surveys of the Project Area (see Figure 4-3). While no grab samples were collected at these sites, a qualitative assessment of the benthic community based on the ROV video is provided below.

## 4.1 Nearshore Community

**(Stations B-7 and B-8)**
A distinct soft bottom community was found at stations located closest to the shoreline (Figure 4-2). Bottom substrates in these areas are comprised of mostly fine and medium sands (greater than 92% composition) at depths between 22 and 26 feet. The benthic samples collected at these sites were dominated by the polychaete *Nephtys incisa* and the amphipod *Rhepoxynius epistomus*. While the abundance (total individual count) at these stations was higher than the offshore community, richness and evenness were lower. This was due to the large percentage of *R. epistomus* in these areas. This resulted in relatively low diversity values for these stations. The lower diversity may be a result of the intense wave action closer to shore or direct anthropogenic use (i.e. swimming) precluding the establishment of sedimentary benthic taxa typically observed in offshore areas.

## 4.2 Offshore Community

**(Station B-1, B-2, B3, B-4, B-5, and B-6)**
A second community was identified at stations further from the shoreline at depths of greater than 30 feet (Figure 4-2). The bottom sediment observed in grab samples (and confirmed by video) is similar to that of the nearshore community, being composed of over 90% medium and fine sands with small pieces of shell material and *Lunatia* egg casings. The major difference between the nearshore and offshore communities is taxa diversity. Dominant taxa collected in the offshore samples include the Atlantic surfclam, *R. epistomus*, oligochaetes, and the polycheates *N. incisa*, *Paraonis* sp. and *Tharyx* sp. Generally, the diversity in the offshore community was higher than the nearshore community, likely a result of the depth of these areas precluding them from the impacts of wave activity.




0 500 1,000 2,000
Feet

**Figure 4-1**
**Shannon's Index**
**Benthic Sampling Locations**
**Summer 2009 Field Survey**

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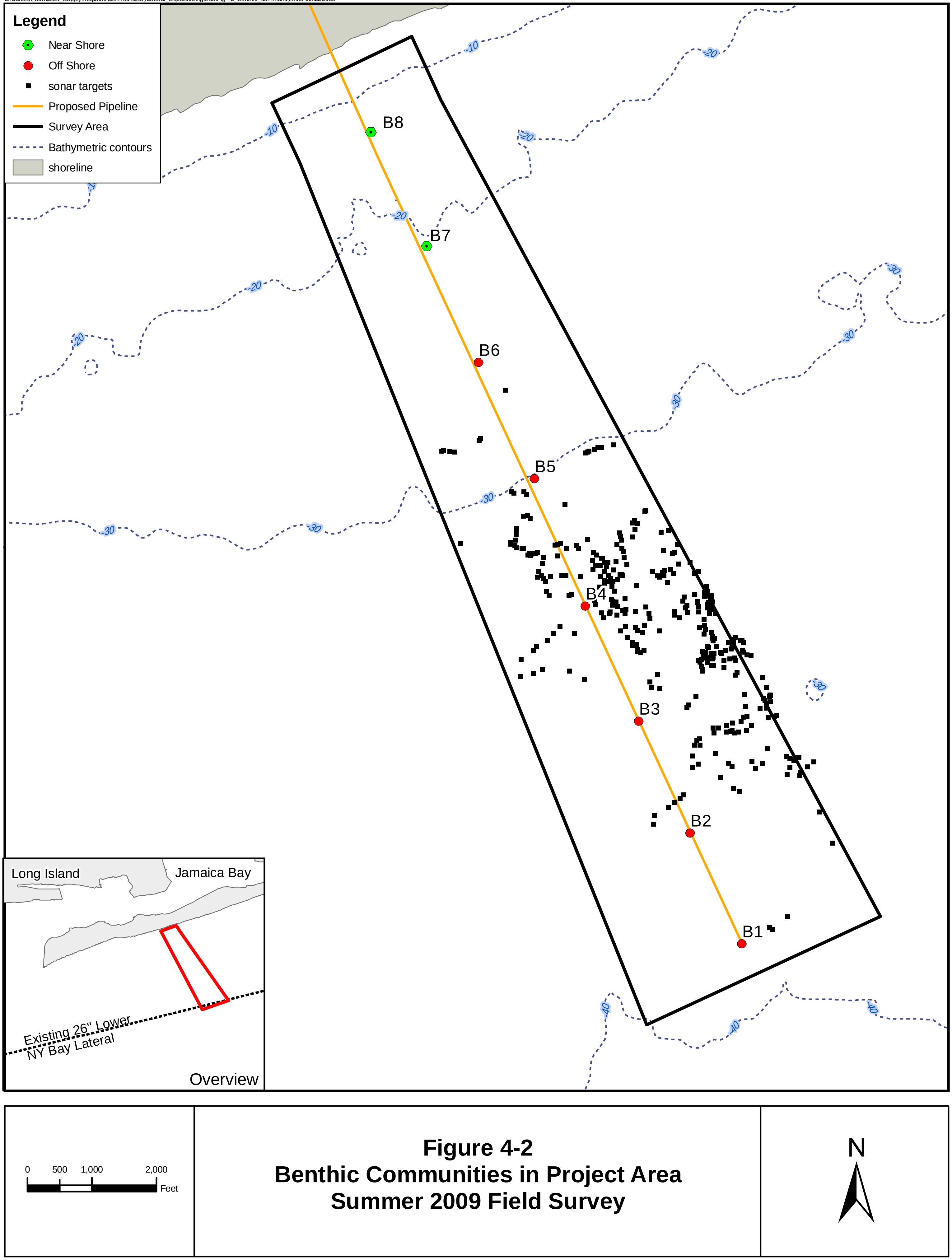


**Figure 4-2**
**Benthic Communities in Project Area**
**Summer 2009 Field Survey**

02:000891.ZW44_03\Figure 4-3.psd - 09/14/09


ROV Locations

Source: PBS&J 2009

**Figure 4-3**
**ROV Features Investigated**
**Summer 2009**
**Geophysical Survey**

N

Station B-6 appears to represent the transitional area between offshore and near-shore communities. Here, species diversity is lower than the other five offshore stations but higher than the two nearshore stations. A shift in overall composition can be seen at this station, as the proportion of polychaetes, oligochaetes, and bivalves have a marked drop in abundance between station B-7 and B-6. In contrast, the total number of crustaceans shows a marked increase between station B-6 and B-5, primarily due to the large abundance of *R. epistomus*.

## 4.3 Anthropogenic Debris Epibenthic Community

### (ROV Hard bottom investigation sites 1-19)

In addition to the two benthic communities identified along the proposed pipeline route, a third community was identified. Based on geophysical investigations (side-scan sonar), 344 targets are distributed throughout the survey area, all of which are associated with anthropogenic debris (see Figure 4-1). A remote operated vehicle (ROV) video investigation of a subsample of these targets (19 sites) revealed that the majority of this debris consists of rock and/or concrete rubble; steel or concrete pipes; cables and rebar; and other construction debris (see Figure 4-3). The majority of this debris is concentrated in the vicinity of a mapped, state-constructed fish haven. Development of the area, as proposed by the New York State Department of Conservation in 1964, commenced in 1967 and consisted of rock, rubble, and concrete structures. The goal of the haven was to attract bottom-feeding fish by simulating an uneven bottom, thus stimulating the growth of epibenthic marine organisms. While the mapped extent of the fish haven falls outside the survey to the east, the concentration of debris near the mapped boundary suggests that the haven extends further to the west. The ROV video was used to qualitatively analyze the marine community inhabiting these structures, including both sessile and motile species, and to determine whether the area of the mapped fish haven extended partially into the survey area.

A qualitative review of the video revealed a variety of organisms living on and around the debris. A number of sessile organisms were found encrusting these materials, including ascidians (sea squirts), sea stars, cnidarians (coral and hydroids), and poriferans (orange sponges). *Lunatia* sp. egg casings were also observed near many of these sites. Numerous fish species were observed utilizing these sites, indicating that the goals of the artificial fish haven (providing habitat and stimulating marine growth) have been at least partially met.

Except for sites 1 and 9, all ROV surveyed sites were dominated by a white cnidarian species. Because of the lack of confirmation of actual species colonizing the debris piles, a second survey was conducted by Dr. Bradley Peterson of the Stony Brook University Marine Sciences Research Center to determined whether the cnidarian species was a hydroid or the Northern star coral, *Astrangia poculata*. The dive survey conducted by Dr. Peterson, identified *A. poculata* as being present in large abundance on a selected sonar target determined to be representative of the debris scattered through the project area. Based on the similarity among all of the ROV investigated sites, it was speculated that *A. poculata* was the dominate cniderian species present at the other ROV surveyed sites.

# 5 Drop Camera Video

A video of the bottom was obtained for the 24 triplicate sampling locations indicated on Figure 4-1 and analyzed to supplement the benthic sampling data. To collect videos of the bottom, a drop camera was lowered to the depth specified for the specific sample location by the fathometer on the survey vessel. The drop camera was allowed to stabilize in the water column until it remained steady enough to obtain a good image. An onboard monitor was used to ensure that the camera was steady and to make initial observations of the benthic community. Once the image was steady, a slow trawl across the bottom captured the bottom video for that location. A CD containing the drop camera video is provided in Appendix D.

Underwater video observations are best used to supplement existing benthic data. Due to the camera movement, shadows, camera magnification, and video quality, it is often difficult to confirm species identification and to determine abundances using only video observations. Specific observations resulting from the analysis of the videos has been incorporated into the discussions in Section 4.

# 6 References

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The appendices/attachments to this document are available for viewing on the FERC website (http://www.ferc.gov). Using the "eLibrary" link, select "General Search" from the eLibrary menu, enter the selected date range and Docket No. CP13-36 (Transco's application), and follow the instructions. For assistance, please call 1-866-208-3676, or e-mail FERCOnlineSupport@ferc.gov.